THURSDAY, FEBRUARY 7, 1901.

A NEO-DARWINIAN ON EVOLUTION.

Problems of Evolution. By F. W. Headley. Pp. xvi + 373. (London: Duckworth and Co., 1900.)

MUCH of the work that has lately appeared on the subject of organic evolution has been characterised, if not by a misapprehension of the main points at issue, at any rate by a want of due proportion in the treatment of data, and by a tendency to build an elaborate superstructure on a very slender foundation of fact. This applies less to the work of English authors than to those of other countries. It is satisfactory to find that English men of science, who have always taken a leading part in the promotion of sound and rational views on the methods of evolution, are still distinguished by the thoroughness and good sense which they bring to bear on the discussion of evolutionary problems.

Mr. Headley's book is on the whole a favourable example of this kind of literature. It is true that his statements of fact are not always free from error, nor are his arguments on all points convincing; he shows, nevertheless, a just appreciation of the difficulties of the subject and a wide acquaintance with the various attempts that have been made towards their solution, while his own suggestions have been well considered, and are often of distinct value. His standpoint is more thoroughly Darwinian than that of many other recent writers, and in him the principle of natural selection as the most important factor in evolution finds a powerful and skilful advocate. He is an uncompromising opponent of Lamarckism, and one of the most satisfactory sections of the book is that in which he shows how completely the Lamarckian principle fails to account for those very phenomena which have been most confidently appealed to in its support. This, however, does not preclude him from recognising the importance of the suggestion made independently by Profs. Mark Baldwin and Lloyd Morgan, viz., that the selection value imparted to a congenital variation by exercise may enable such variation to become the starting-point for other variations in the same direction (Darwin's "Continuity of Variation"). Not only does he adopt the principle in the form here stated, but he goes on to show that parental care and the gregarious habit may act in a similar way by promoting the survival of certain characters which can be increased by practice, and so giving an opportunity for their enhancement, by further variation, in successive generations. But he rightly points out that this cannot properly be claimed by Lamarckians as a concession to their views; those who would so claim it must have, as he says, "a singular power of mistaking an utter rout for a compromise." For, as Prof. Lloyd Morgan makes clear, there is here "no transmission of modifications due to individual plasticity"; and what really emerges is that natural selection is capable, without such transmission, of doing all that was exclusively claimed on behalf of Lamarckism.

On the defensive side, Mr. Headley makes a forcible use of the phenomena of adaptation. He has little to bring forward that is actually new on this head, but his statement of the case is a clear and cogent one. The principle of recognition marks is acknowledged by him as supplying the key to many instances of apparently useless characters, and this line of argument might profitably have been expanded. He is on strong ground when asserting the importance of slight points of difference.

> "Two races are brave beyond dispute, but one will stand a little longer under fire than the other, and it is this little that makes all the difference in the struggle. Two young men are about on a par, and seem likely to run neck and neck in the race of life, but an almost imperceptible superiority in one seems to act with cumulative effect, and in twenty years, say, he is miles ahead."

The latter illustration will appeal to most readers with experience of life.

The author's treatment of the important subject of variation is interesting and suggestive. True to his anti-Lamarckian principles, he denies any direct influence of the environment on the origin of variations properly so-called: "An external condition can do nothing but bring to light some quality" already latent. To explain the variations among offspring we must fall back on the doctrine of the continuity of the germ-plasm coupled with the specialising effect of cell-division.

> "When fission takes place, inequality must result. . . . There is a thorough shuffling of the cards before they are cut."

This view is to some extent akin to Weismann's earlier position as to the import of reducing divisions and amphimixis. But the author goes further than Weismann. Not only have the reducing divisions of the germ-cells in the metazoa the value of an incipient specialisation, but the simple fissions of the protozoa have precisely the same significance. Over-specialisation, such as would in many cases result from a process of fission indefinitely continued, is a cause of failure and death. This in the bulk of the protozoa, at all events, is counteracted by periodical conjugation, which tends to restore to each cell some elements which it had lost, or was in process of losing, by repeated fission. Amphimixis in the metazoa has a similar *rôle*. Hence both fission and conjugation, or amphimixis, are a cause of variation, though the latter, while increasing the possibilities of deviation, tends to prevent it from taking a harmful direction. An obvious criticism on this view is that two imperfect organisms do not necessarily make a perfect one. The speculation, nevertheless, is ingenious and interesting, even though it may fail to convince.

In a further discussion of that perfection of adaptation which almost appears to call for a "directive force" presiding over variation, he takes occasion to give an account of Prof. Weldon's application of the law of chance. The argument is fairly stated, but in his comments upon it Mr. Headley seems disposed to blame Prof. Weldon's results for not clearing up points with which they were never intended to deal. His criticism is thus somewhat beside the mark, for, as he himself admits, Prof. Weldon's aim was chiefly to demonstrate the high probability of advantageous variations affecting a large number of individuals at the same time, in this way affording abundant material for selection. The question why variation should take one direction more than another belongs to

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a distinct line of inquiry. In framing his own answer to the question, the author lays stress on the controlling power of heredity, on Darwin's principle of "continuity of variation," or, as he prefers to call it, "sequence of variation," and also on the fact that the variations of the organic environment of a species—the several other species, that is to say, with which it has to keep *en rapport*—being subject to similar limitations with its own, are not likely to set it an impossible task in the way of providing fresh adaptations. Moreover, there are usually periods in the history of a species when it has, as it were, a choice of environments, so that the possibilities of adaptation open to it are enlarged. This latter position might well have been illustrated by the striking case of certain mimetic butterflies; amongst which it is often found that species closely allied to one another, and sometimes even the two sexes of the same species, have been drawn apart, so to speak, into separate protected colour-groups; while still other species of the same affinities occupy intermediate positions, ready, as it were, to throw in their lot with this or that colour-combination, according to their needs. The upshot of the author's contention as to variation and adaptation is, that while the range of possible variation is not indefinite, but necessarily limited, the limitation is in no sense due to the direct action of the environment; still it is this very limitation that renders adaptation possible, by ensuring a supply of such material as is capable of being moulded by the selective action of the existing external conditions. Variation that took place merely at random, were it conceivable, would almost inevitably consist of all misses and no hits.

In the second and concluding part of the book, Mr. Headley deals with the application of evolutionary doctrine to the problems of human development. His treatment of this part of the subject, as of the other, shows freshness, vigour and ability; but he could here hardly avoid raising points of a highly controversial character, and most of his conclusions are likely to be sharply assailed. Adopting in many respects the point of view of Mr. Benjamin Kidd, he discusses at length the origin and influence of the moral sense, and the various conditions that with advancing civilisation tend to defeat or delay the operation of natural selection. The antagonism between altruism and the "cosmic process," which was adumbrated by Huxley in his memorable Romanes lecture, receives a careful and extended treatment; and the author states his own conclusion somewhat as follows:—The development of human intelligence has in many ways checked the wholesome operation of natural laws. Being capable of exercise in anti-social directions, it has in times past threatened the well-being if not the very existence of the race. From this fate humanity has so far been preserved by the practice of altruism under the sanctions of religion and morality. Supposing this first peril to have been successfully met, there remains the further danger of physical degeneration, which may presently become imminent, and the proper treatment of which is among the most important problems that await us. In spite of his indictment of human reason, Mr. Headley is no pessimist. So far from having lost confidence in the future of the race, he looks boldly to the old sanctions, under higher and more enlightened forms of application, to save the human species from physical, as they already have from social disintegration. It is obvious that the working out of this idea, which indeed is not attempted by the author himself in any detail, involves considerations which are unsuitable for discussion in a notice like the present. Suffice it to say that Mr. Headley does not write at random; and that his views challenge attention, whether sympathetic or otherwise.

Notwithstanding an occasional abruptness and jerkiness of style, the author writes well and expresses his views with clearness. More care might with advantage have been bestowed on the proofs; misprints are not uncommon, the punctuation frequently leaves much to be desired, and there is a curious lack of uniformity in the use of scientific names. Some questionable palæontology will be found on p. 105, and some equally doubtful pathology on pp. 246, 247. An inaccurate use of the term "chrysalis" may be noted on p. 59. But in spite of these and other failings the book reaches a high standard of merit, and should appeal to a wide circle of general readers besides those more especially conversant with the subjects of which it treats. F. A. D.

THE CENTURY OF SCIENTIFIC PROGRESS.

The Story of Nineteenth Century Science. By Henry Smith Williams, M.D. Pp. x + 476. Illustrated. (London and New York: Harper and Brothers, 1900.) Price 9*s*.

THE story is worth telling, for whatever the ages may hold in store they can hardly deprive the nineteenth century of the distinction of having witnessed a progress in science without a parallel in the earth's history. Each step in advance has served as a starting-point for many others, and the record of the last quarter century, even of the last decade, far surpasses that of the corresponding period at the outset. The opening chapter of this book, "Science at the Beginning of this Century," enables us to realise how immense the gain has been.

To write such a history is a task on which, at the beginning of the century, an author might have entered with a light heart. Now such an undertaking seems almost an audacity. Scientific omniscience has long become impossible; but in an age of such rapid progress something of the kind is required for a work like this. The reviewer is in a still worse plight. How can he—probably almost wholly occupied in trying to carry some one road a little farther into the unknown land—be competent to decide whether the author has done full justice to those similarly engaged in other directions? So I shall speak critically only of my particular subject, and for the rest briefly touch upon the salient features in the author's narrative. The book, I may remark, evidently had its origin on the other side of the Atlantic, so that the illustrations have a slightly American tinge. The same also may sometimes be said of the English. As example, "down" is a new verb to us; "per hypothesis" jars on the ear; to say that a man was "then only a novitiate in science," startles any one accustomed to employ the word novice. Such solecisms, however, are but few. The chapter on palæontology seems oddly placed between

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